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ABSTRACT

Developed by the ABCs of Construction National Workplace Literacy Project, these curriculum materials for the area of electrical and instrumentation contain a lesson that deals with problem solving using charts and tables. The lesson consists of an objective, instruction, and 10 exercises. The objective for the lesson is for the student to learn to solve problems with charts and tables. The problems found in the 10 exercises accompany the tables in a companion manual, "Reading Charts and Tables. Electrical & Instrumentation." (YLB)

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ED 374 291

TECHNICAL DEVELOPMENT CENTER

Problem Solving using Charts and Tables

E & I

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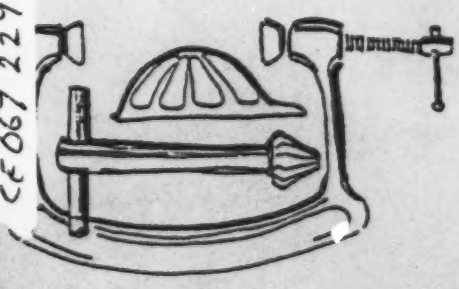

Associated Builders & Contractors, Inc.
EBR Adult & Continuing Education

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ABC's of Construction
National Demonstration Project in Workforce Literacy

The ABC's of Construction Project was funded in 1991 by the U.S. Department of Education as a grantee through the National Workplace Literacy Program (PR #198A10155). The program provided basic skills instruction to industrial construction workers employed by companies which are members of the Pelican Chapter of Associated Builders and Contractors (ABC). Located in Baton Rouge, Louisiana, ABC provides training to employees of over 60 member companies who perform contract work in the 58 petrochemical facilities located along the Mississippi River between Baton Rouge and New Orleans.

The grantee, the Adult Education Department of East Baton Rouge School Board, performed a comprehensive literacy task analysis of the apprenticeship training program for millwrights, pipefitters, electricians, instrumentation techs, and welders involved in the ABC training program. Over 20 modules of original, contextual curriculum were developed to teach the reading and math skills required for success in the craft training program.

Materials developed for instruction incorporated cognitive strategies for learning basic skills in the context of the craft and safety knowledge demanded by the industrial construction workplace. Instruction was written for a competency-based, open-entry/open-exit, individualized adult learning program that operated at the ABC training center in the evenings after work-hours.

SOLVING PROBLEMS WITH CHARTS AND TABLES

OBJECTIVE: You will learn to solve problems with charts and tables.

Jess is installing conduit. He uses the zip guide for offsets. He can use a bend of either 4 or 5 inches. Each bend has a different distance between bends. What is the difference between these distances?

ZIP GUIDE
FOR OFFSETS

OFFSET DEPTH INCHES	DISTANCE BETWEEN BENDS	ANGLE OF BENDS	CONDUIT SHORTENS
2	5 ¼	22 ½ °	⅛
3	6	30°	¼
4	8	30°	1
5	7	45°	1 ⅞
6	8 ½	45°	2 ¼
7	9 ¾	45°	2 ⅝
8	11 ¼	45°	3
9	12 ½	45°	3 ⅜
10	14	45°	3 ¾

START BENDS AT ARROW ON TOP

Sometimes you need to do more than look up information on a chart. You need to solve a problem using information in the chart. How do you do that?

You need to be able to do five things:

(1) Identify the question you want to answer.
(2) Decide what operation (addition, subtraction, multiplication, division) you need to use.
(3) Determine what information you need from the chart.
(4) Plug the information into your operation.
(5) Work the problem.

Look at Jess's problem again.

Jess is installing conduit. He uses the zip guide for offsets. He can use a bend of either 4 or 5 inches. Each bend has a different distance between bends. What is the difference between these distances?

What is the question he wants to answer? He wants to know the difference in distance between bends for 4 and 5 inch bends.

What operation does he need? Jeff knows that "difference" means he should subtract.

What information does he need from the chart? He needs the distance between bends for 4 inches. That is 8. He needs the distance between bends for 5 inches. That is 7.

Plug the information into the problem. 8 - 7 = _____

Work the problem. 8 - 7 = 1

Now Jess has the answer. There is one more step he should follow. This step is **"Does that make sense?"** Some people think that if they use a calculator, they will always be right. This is only true if you put the right numbers into the calculator. Only you can determine if the answer seems right based on your experience.

The following problems accompany the tables in E&I READING CHARTS AND TABLES.

EXERCISE #1 ELEMENTS AND THEIR ATOMIC SHELLS

1. Kim counts the number of elements that have electrons in the seventh shell. How many elements do NOT have electrons in the seventh shell?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Kim examines the chart. How many electrons does she find in sulfur?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Kim uses iron often. How many electrons are in Iron.

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

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4. Curium is a new element to Kim. How many electronsare in it?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

5. Kim often uses conduit with a lead sheath. How many electrons are in lead?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

EXERCISE #2 EVERDUR RIGID CONDUIT

1. Jeff is installing 3/4 inch conduit. What is the difference between the outside and inside diameters?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. What is the difference between the outside and inside diameter for 1 inch conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. What is the difference between the outside and inside diameter for 3 inch conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

4. Write your answers for questions 1-3 in the spaces below. Then fill in the space for wall thickness using information from the chart. What relationship do you find between your answers and the wall thicknesses?

3/4 inch _____ wall thickness _____

1 inch _____ wall thickness _____

3 inch _____ wall thickness _____

relationship _____

_____

What is another way in which you could find the difference between the outside and inside diameter WITHOUT subtracting?

_____

5. What is the difference in wall thickness between 1 inch and 4 inch conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

6. Jeff compares unit lengths of conduit without couplings. What is the difference between the largest and smallest length?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

7. Jeff must rig a load of conduit. He has 10 unit lengths of 3/4 inch conduit and 10 unit lengths of 4 inch conduit. What is the total weight of the load?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

8. Jeff must move 70 unit lengths of 1/2 inch conduit. For what weight should he rig the load?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

9. Jeff just moved 10 unit lengths of 3 inch conduit. Now he must load 10 unit lengths of 3 1/2 inch conduit. By how much weight should he adjust the rigging?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

10. Jeff has 10 unit lengths of each size of conduit. What is the total weight of the conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

EXERCISE #3 FLEXIBLE STEEL CONDUIT

1. Rex is comparing the number of feet per coil. What is the difference between 1 inch and 3 inch coil?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Rex must load some conduit. He has 4 coils of 5/16 inch conduit. How much does it weigh?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

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3. Rex has 500 feet of 1 1/4 inch conduit. How much does it weigh?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

4. Rex is comparing the bending radius for 2 inch conduit and 3 inch conduit. What is the difference in radius?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

5. Rex needs 250 feet of 3 inch conduit. How many coils does he need?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

EXERCISE #4 ELECTRICAL METALLIC TUBING

1. **Zandra is using 3 inch and 4 inch tubing. What is the difference in the raduis to the center line of tubing?**

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Zandra is using 2 and 2 1/2 inch tubing. What is the difference between the shortest acceptable lengths for each straight end piece?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Zandra compares the sizes of the largest and smallest sizes of tubing. What is their difference?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

4. Plans call for 3/4 inch and 1 inch tubing. What is the difference between their smallest acceptable radius R to center line of the tubing?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ **How do you know?**

_____

5. Zandra has 1/2 inch tubing. She needs 1 inch tubing. What is the difference in their shortest acceptable length Ls of each straight end portion of tubing?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

6. Zandra has 2 inch tubing. She knows the length of the smallest acceptable radius R to center line of tubing. She wants to double that amount. How much would that be?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

7. Zandra has 3 inch tubing. She knows the shortest acceptable length Ls of each straight end portion of tubing. She wants to triple that number. What is the answer?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

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8. Zandra compares the shortest acceptable length Ls of each straight end portion of tubing. She uses 1 inch and 1 1/2 inch tubing. What would be the total length of both of them combined?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

9. Zandra has 1 and 1 1/2 inch tubing. What is the difference in their smallest acceptable radius Rs to center lines of tubing?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

10. Zandra has a 7 inch piece of 4 inch tubing. She marks the tubing at the point of the shortest acceptable length L of one straight end portion. How much tubing is left?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ **How do you know?**

_____

EXERCISE #5 NO QUESTIONS AVAILABLE

EXERCISE #6 MINIMUM DEPTH OF CLEAR WORKING SPACE IN FRONT OF ELECTRIC EQUIPMENT

1. Al is checking panel installations. He just finished wiring a panel rated at 85kV. He thought that the equipment had exposed live parts only on one side. Thus, he installed according to condition 2. He now sees live parts on both sides. He needs to modify it to meet condition 3. How much additional space does he need?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Al must install 2 panels. One is at 25,000 volts. It meets condition 2. The other is at 30,000 volts. It meets condition 1. What is the difference in spacing?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Al is installing 2 panels. Both meet condition 3. The first panel is rated at 1000 volts. The second is rated at 100 kV. What is the difference in installation depths?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

EXERCISE #7 RADIUS OF CONDUIT BENDS

1. **Joe is checking his crew's work. Plans call for 2 inch conduit behind a panel. The crew installed 1 1/4 conduit. The conductors have a lead sheath. What is the difference between the radius of bends?**

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Joe checks the size of conduit. He finds it to be 4 inches. The crew used conductors with lead sheaths. They were supposed to use conductors without lead sheaths. What is the difference in the radius of conduit bends?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Joe's crew used 2 sizes of conduit. They used conductors without lead sheaths. One radius was 5 inches. The other radius was 36 inches. What is the difference in the sizes of the conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

4. Joe's crew is using 6 inch conduit. What is the difference in radius of bends? They must do one job with lead sheaths and one without.

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

5. Joe's crew used the smallest and largest size of conduit. The installation called for conductors without a lead sheath. What is the difference in their radius of bends.

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

6. Joe's crew used 2, 4, and 6 inch conduit. Plans called for conductors with lead sheaths. Which pair (2 and 4, 4 and 6, or 2 and 6) has the least difference in radius of conduit bends? What is that difference?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

7. Joe found one bend to be 40 inches. He found a second to be 16 inches. Both used conductors with lead sheaths. What is the difference in the sizes of the conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

8. Joe found one bend to be 11 inches. He found a second to be 61 inches. Both used conductors with lead sheaths. The job called for conductors without lead sheaths. If the crew used the same sizes, what would be the difference between the bends for conductors without lead sheaths?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

9. Joe has 3 inch conduit. What is the difference in radius of bends for conductors with and without lead sheaths?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

10. Joe found a bend with a radius of 15. He found a second bend that was double that number. Both used conductors without lead sheaths. What is the difference in the sizes of the conduit used?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

EXERCISE #8 IDENTIFICATION NUMBERS

1. Lyman has equipment marked T3. Other equipment is marked T6. What is the difference in their maximum temperatures in degrees C?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Lyman checked the temperature. It was 400 degrees F. He was supposed to install equipment indentified as T3B. What is the difference in the maximum temperature and the temperature of the area?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Lyman has 2 pieces of equipment. One has the highest maximum temperature rating. The other has the smallest maximum temperature rating. Both are rated for Degrees F. What is the difference in the maximum temperature?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____ _____

4. Lyman compares degrees C and degrees F for items labeled T4A. What is the difference?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

5. Lyman installed T2A and T2C equipment. He compares degrees C and degrees F maximum temperatures. Which has the greatest difference? What is that difference?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

6. Lyman has equipment marked T1. Other equipment is marked T5. What is the difference in their maximum tempertaures in degrees F?
What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

7. Lyman installed equipment marked T2 and T2D. What is the difference in the maximum temperature in degrees F?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

8. The temperature in a boiler area reaches 275 degrees C. Lyman checked equipment before installation. It is identifed as T3A. What is the difference between the rated temperature and the temperature in the area?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____ _____

9. Lyman installed equipment rated as T4. He checked the temperature in the room. It was 275 degrees C. What is the difference between the rated temperature and the temperature of the room?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

10. Lyman has equipment rated T2A, T3A, and T4A. Which pair (T2A and T3A, T3A and T4A, T2A and T4A) has the greatest difference in temperatures in degrees F? What is that difference?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

EXERCISE #9 NO QUESTIONS AVAILABLE

EXERCISE #10 ALUMINUM RIGID CONDUIT

1. Ajay ordered 950 feet of 1 inch conduit. How much will it weigh?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

2. Ajay ordered 12 bundles of 3 inch conduit. How much will it weigh?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Ajay received 7 master shipping packages. 3 were 2 inch conduit. 2 were 1 inch conduit. The rest were 6 inch conduit. What is the total weight of the order?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

4. Ajay received 3 bundles of 3/4 inch conduit. He got 8 bundles of 1 1/4 inch conduit. He has 9 bundles of 3 inch conduit. What is the total number of pieces he received?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

5. Ajay ordered 16 master shipping packages. Half were 1/2 inch conduit. 1/4 were 2 inch conduit. The rest were 6 inch conduit. How many pieces of conduit did he receive?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Ajay ordered 9 more master shipping packages. One third of them were 1 1/2 inch conduit. The rest were 3 1/2 inch conduit. How many feet of conduit does he have in all?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

7. Ajay rigged a load for 750 pounds. He receives 12 bundles of 6 inch conduit. What is the difference between the amount the rig can hold and the weight of the conduit?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

3. Ajay ordered 150 feet of 3 inch conduit. How much does it weigh?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

9. Ajay ordered one bundle in each size of conduit. How many pieces does he have in all?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____

10. Ajay ordered one master shipping package for each size of conduit. What is the total weight of the conduit he received?

What is the question?

_____

What operation is needed?

_____

What information do you need from the chart?

_____

_____

Plug in the values.

Work the problem.

Does it seem correct? _____ How do you know?

_____